ABSTRACT

Managers implementing CASE face one of the biggest challenges of their careers. It's a continuous balancing act. They must keep the expectations of top management in order, meet project schedules and encourage the effective use of CASE.

This paper outlines a plan for introducing CASE in your organization. It will help make the transition less risky and much easier by providing a step-by-step implementation plan. It will also help ensure the entire organization benefits from CASE by helping you better understand the critical "people" issues that lead to successful technology transfer in larger organizations.

Recently, many software tools have entered the market under the banner of CASE, or Computer-Aided Software Engineering. The birth of CASE has brought both excitement and frustration to those trying to implement it inside their companies. On one hand, CASE promises to turn software development into an engineering discipline. On the other hand, it is an extreme challenge to persuade an organization to adopt a new way of developing software. You'll notice that the title of this paper does not mention productivity. I've thrown that word out of my vocabulary for now, because I know it will come -- after we are able to achieve higher quality.

This paper describes how to implement CASE within an organization. The key to success will be to focus on the people affected by the change, rather than simply on selecting the right CASE software products.

During the last two years, I have had the opportunity to help a number of organizations adopt CASE, while also helping minimize the fears and doubts that accompany such technological change. I call my approach the CASE Implementation Project.

I would like to take full credit for the ideas used in my approach, but they are actually the culmination of many people's work, including several noted authors and consultants. (Please see the References section at the end of this paper.)

The CASE Implementation Project is like any other software development project:

- It has goals, objectives and time frames.
- It contains a number of tasks, which must be performed in a particular order.
- It has deliverables which, if clearly defined, will diminish the uncertainty of management and the technical staff as the project proceeds.

These deliverables can be used to monitor progress and change as the CASE Implementation Project progresses. This further minimizes any false starts.
The overall goals of the CASE implementation project are to help your people:

- Understand the strengths and weaknesses of your staff and current procedures.
- Identify valid software engineering methods to be used in analyzing user requirements, and designing the software to fulfill those requirements.
- Select CASE tools to support the methods being used to design, build and maintain your software assets.
- Develop a comprehensive training program to train your staff in the methods and tools necessary to improve the quality of your software and the productivity of your staff.

These changes will occur only as a result of a well developed plan, one that has the full endorsement of top management and from those who will be affected most -- your software development staff and the users. With full commitment -- up and down the chain of command -- CASE will be successful. And selecting the tools and methods will be easy by comparison.

A typical plan for the CASE Implementation Project is shown in Figure 1. The major deliverables for each phase are shown in Figure 2. The remainder of this paper describes the CASE Implementation Project in more detail.

Next, each group of people affected by CASE will need to be trained separately, according to their needs. This can be accomplished through a series of in-house seminars appropriately geared toward each group. The seminars can be used to educate and inform, as well as to sell the benefits of CASE. These seminars will also help ease the transition for your staff by providing consistent, comprehensive information. By building on what your staff already knows, the transition will be smoother, and your staff will find solutions more quickly.

The first objective of the CASE Steering Committee is to develop a charter and a plan. The charter might be based on a statement similar to the following: "This committee has been formed to find ways of improving our software products and services, which have become a crucial part of our business strategy and organization." The charter might also include some objectives formed by the Steering Committee. These objectives will provide a starting point. More precise objectives will be determined during the software engineering assessment phase.

You'll need to fine-tune your decisions as you change your organization. Management and the CASE Steering Committee must constantly evaluate the decisions to ensure the organization is on track and that people continue to be committed. Be prepared to discard any tools or methods that don't improve the quality of your systems. If people don't believe the new tools and procedures are helping, then they probably aren't helping.

Your organization has probably decided to implement CASE because you know your software development organization could be more efficient. You may feel that (1) your systems are not helping the organization meet its goals; (2) projects are coming in late and over budget; (3) the users are complaining; (4) software enhancements take too long.
Case Implementation Project
Project Plan
Figure 1

1. Start-up Project
2. Assess Current Practices
3. Establish Guidelines and Design Techniques
4. Educate Staff on Standards
5. Select CASE Tools
6. Conduct Pilot Projects
7. Assess Effectiveness
8. Implement CASE Throughout Your Organization

2 months ← 4-6 months * ← 4-6 months * ← 18-36 months *

* These elapsed time estimates are for planning purposes only. They are subject to change based on the results of Phase 2, Assess Current Practices

** These phases are repeated for each major area of CASE Technology being investigated (e.g. Analysis/Design, Project Management, Configuration Management)
It's important to combine your perceptions with hard facts in order to fully assess the situation and develop a list of suggested changes. Here is the information you will need to make this list of changes:

- Perceptions from management, users and technical staff.
- Information from the staff on the current practices within the organization.
- A detailed review of past projects -- both successful and unsuccessful -- to determine the effectiveness of your current practices.

You may wish to develop a questionnaire to help you with your assessment. Be sure to address:

- Business strategy and the impact that software has on that strategy.
- The experience level of your software development organization.
- Current Methods (e.g. Yourdon, Information Engineering, Flow Charts, HIPO) used on previous projects.
- Strengths and weaknesses of your software development process and organization.
- Current CASE tools in use and their strengths and weaknesses.

A detailed software engineering audit questionnaire may be found in Making Software Engineering Happen, an excellent book by Roger Pressman, published by Prentice-Hall [1].

After information has been gathered in the audit, prepare a CASE implementation proposal that outlines the findings and recommendations for improving the practices in your organization. Recommendations should address the areas of organization, methods, education, CASE tools and the development hardware and software environment. Make sure the proposal includes a detailed plan for accomplishing the recommendations.
It is important to identify benefits that will result from implementing the recommendations. These benefits should be as specific (or measurable) as possible. For example, define a percentage reduction in the number of problem reports that should result from implementing CASE. If you can't set concrete goals at this point, at least establish the categories now. The details can be filled in as the planning and selection process proceeds. Eventually, management will need to know specific benefits, not simply hear ambiguous statements such as "we will have better software."

Once the findings and recommendations are compiled, the CASE Steering Committee must meet to 1) present the findings and recommendations and 2) gain consensus before approaching senior management for approval and funding of the plan.

Phase 3 - Establishing Guidelines and Design Techniques

Once you've assessed the current practices within your organization, you must establish project management and software design guidelines. These guidelines, or “standards,” will enable your organization to select CASE tools more easily and achieve the increases in quality or productivity.

Many organizations fear that standards inhibit creativity. I believe that standards allow us to establish systematic approaches for design issues where creativity isn't important. We can then devote more time and creative energy to the design issues where creativity counts.

There are several types of standards, and each requires a separate CASE Implementation Project. These include:

- Project Management.
- Software Design.
- Re-engineering.
- Testing.

The results of the software engineering assessment should indicate which areas to target. Once you've determined which areas to undertake, divide the CASE Steering Committee into working groups to address each area. Consider the expertise of the individuals or the departments they represent in setting up these working groups. People will stay interested and more focused when they are handling issues that are relevant to their area of expertise.

Project Management Standards

You can either buy these standards or design them yourself. Several "off-the-shelf" standards provide detailed, step-by-step approaches to many of the areas listed above; however, many companies feel they cannot work with a packaged standard. Often these off-the-shelf standards fail because the staff receives inadequate training.

If possible, review and consider the packaged standards before deciding to build them yourself. Just as with software, if you build them yourself, you must have staff who will update them as needed. If you don't, you are wasting your money.

Software Design Standards

According to a November 1987 survey conducted by Software Magazine, more than 70 percent of organizations using a software design approach were using Yourdon Structured Methods or one of its derivatives. Other design approaches to choose from include James Martin's Information Engineering, Warnier-Orr and the Jackson Method [2] [3]. Select a design approach -- preferably one that has reasonable acceptance throughout the software industry -- and employ it! The one you choose really depends on the type of systems you build. For example, Yourdon is function-oriented and useful for both business and real-time systems. Information Engineering is data-oriented, and may be less useful for real-time systems.

Your standard methods might not suit every project. You must have flexibility to allow some projects to "do their own thing." If this attitude is adopted in the right situations, true innovation can occur and benefit the entire organization. Furthermore, you will keep your staff intrigued and excited about CASE.
Once you select the methods your organization will support, prepare a training program that supports the type of systems you build and the methods you have chosen.

**Re-engineering and Testing Standards**

These areas of software development have only recently gained significant awareness. Few, if any off-the-shelf standards exist today. If this area is important to you, you will probably have to write your own standards. It may help to call in experts or work closely with the vendors of re-engineering and testing tools.

**Phase 4 – Educating the Staff on the Guidelines**

First, choose appropriate "pilot" projects for your staff. These are the projects on which they will test your new standards and CASE tools before implementing them throughout the organization. Choosing the right projects requires you to prepare selection criteria and then review available projects. Don't select those that are already behind schedule, or projects that are critical. Choose projects that require a variety of resources, including both experts and novices. Often, members of the CASE Steering Committee can suggest appropriate projects. If they meet the criteria, use them, since those people on the Steering Committee have a great deal of interest in seeing CASE be successful.

The training should be spread out over the course of the project, so that analysis training is given when the staff begins analysis; design training starts when they begin design, and so forth. In other words, the training courses must be modular so they can be offered to the project teams as needed.

**Phase 5 – Selecting CASE Tools**

Implementing CASE into your organization is hard work, and it's easy to feel overwhelmed -- especially if you haven’t chosen your CASE tools yet. But you must build a proper foundation so that your CASE tools don't end up being "shelfware."

Base your selection on the following:

- Critical areas identified during the software engineering assessment.
- Kinds of systems or software products you build.
- Tools you are currently using.
- Software design or re-engineering standards you have selected.
- Hardware and system software you use for development.

Look at your company’s investment in each of the above areas. If you have already invested heavily in a particular area, then this area may be around for quite awhile. (Remember, the demise of COBOL has been forecast for 20 years.) Try to make your existing investments work for you, but if one of these areas is part of the problem, then you'll have to justify its replacement. The more investment you've made so far, the more difficult it will be to justify its replacement. If well entrenched technology needs to be replaced, consider a longer transition period where both the old and new technology are supported. Use the pilot projects (Phase 6) to help promote the benefits and success of the new technology.

After prioritizing your selection criteria you must select candidate tools. You have an incredible number of tools to choose from, but there are ways to narrow the field. Ask other developers in your industry. (They may, however, not want to help you if they are using CASE to improve their own competitive advantage.) Attend conferences that bring a number of vendors and users together for several days of lectures and demonstrations. You may also want to search out independent CASE Tools Laboratories, which are starting to appear around the country. It is also valuable to subscribe to newsletters that focus on the CASE Industry.
After you've narrowed the choices to "a few good tools," bring them in-house for a more detailed review. Try them on some tasks that simulate your environment. Get the developers on the CASE Steering Committee Working Group to try them.

Once the detailed reviews are completed, you should have a set of tools ready to use in pilot projects.

**Phase 6 - Conducting Pilot Projects**

Having chosen your methods and tools, you're ready to show that CASE really works. There needs to be at least one pilot project for each significant standard and associated tool. After you assemble the project teams:

- Review with team members -- as a group -- the new methods they will employ as defined in Phase 4.
- Familiarize them with the CASE tools they will use on the project.
- Install the tools in their development environment.
- Allow extra time in the project schedule for the team to learn and adopt the new tools and procedures.
- Make sure that for each pilot project, someone documents how the tools and methods aid or hinder their progress. Ideally, the person assigned to this task should have no other project responsibilities.

Once the pilot projects begin, experts on the tools and methods should be available to answer staff questions. Initially, the "experts" may be vendors or consultants, but as your staff gains experience, they too will become knowledgeable. In the beginning, the experts should be assigned to the project as team members. If this is not practical, part-time experts should be available to answer questions and solve problems as they occur. The project team needs timely answers to their questions; they cannot afford to wait days or even hours for answers.

Make sure each pilot project team is aware of the others. People who are using the same tools should be encouraged to share their successes or problems with each other.

Once the pilot projects are completed, make the results available to the CASE Steering Committee, so they can refine the selected methods, tools and education programs as needed.

**Phase 7 - Assessing the Effectiveness of CASE Technology**

Use the data from the pilot projects to determine the effectiveness of the new standards and CASE tools. Refine the use of the CASE technology where needed. Go back and repeat Phases 3, 4 and 5 as required to fine-tune the standards, the training or the CASE tools.

It is important to document changes and the reasons those changes are being made. Then communicate this information to management, the CASE Steering Committee and the technical staff. This step may be as important as making the changes themselves.

*Education and extra time are the two critical success factors.* As stated earlier, each step of the training should be provided at the proper time for maximum impact and retention. Also, training the team, rather than individuals or small groups, improves morale while encouraging the use of new methods and tools to solve the team's problems.
Phase 8 - Implementing CASE Throughout Your Organization

Tools and methods that prove to be effective should become standards within your organization. Train other project teams on how to use the methods and tools, and encourage their use. Encouragement is the key word. People need proper training and the guidance of experts to make sure they have the little successes that will lead to widespread use of the methods and tools throughout your organization. Remember, the experts may start out as vendors or consultants, but eventually you should be able to grow your own in-house experts.

"Success breeds success," goes the old saying. Establish an effective communication channel, so when someone finds a tool or method that works well, everyone can benefit from it.

The CASE Implementation Project works for organizations of any size, but the speed at which CASE spreads through your organization will depend on several factors, including:

- Management style and organizational structure.
- Available resources to focus on CASE.
- Size and geography of your organization.

Long-term success of CASE in medium to large organizations may well depend on creating a new organization you might call the CASE Tools Group. This group houses the staff responsible for maintaining the standards, provides the training on CASE technology as well as the continuing research on CASE. Since CASE is brand new, we can expect major changes in standards and CASE tools over the next decade. You may need dedicated resources to focus on CASE if it is to benefit your organization.

The time to start implementing CASE is now. As CASE software tools and methods continue to evolve, the benefits of using CASE can only increase. But by starting the process today, you will reap the benefits of CASE already available. You'll also be well on your way to improved efficiency -- and increased productivity.

REFERENCES

